

## JOINED BODIES AND HIGH-PRESSURE DISCHARGE LAMPS

### CROSS REFERENCE TO RELATED APPLICATIONS

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This application is a division of U.S. Application Serial <sup>now US Patent No. 6,642,654,</sup> No. 09/847,058, filed May 1, 2001, which is a continuation-in-part of U.S. Application Serial No. 09/794,760, filed February 27, 2001, <sup>now abandoned,</sup> which in turn is a continuation-in-part of U.S. Application Serial No. 09/631,419, filed August 3, <sup>now US Patent No. 6,703,136,</sup> 2000, the entireties of which are incorporated herein by reference.

### BACKGROUND OF THE INVENTION

#### 1. Field of the invention

[0001] The present invention relates to a joined body, particularly relates to a high pressure discharge lamp using a ceramic discharge tube.

#### 2. Description of the Related Art

[0002] A high pressure discharge lamp has a ceramic discharge tube with two end portions, in which sealing members (usually referred to as a ceramic plug) are inserted, respectively, to seal the respective end portions. A through hole is formed in each sealing member and a metal member, to which a predetermined electrode system is attached, is inserted within the through hole. An ionizable light-emitting material is introduced and sealed within the inner space of the discharge tube. Known high pressure discharge lamps include a high pressure sodium vapor and metal halide lamps, the latter exhibiting more superior color coordination. The lamp may be used in high temperature condition by forming the discharge tube by a ceramic material.

[0003] In such discharge lamp, it is necessary to air-tightly seal between the end portion of the ceramic discharge tube and a member for supporting an electrode system. The ceramic discharge tube has a main body with a shape of a tube with two narrow ends, or a barrel, or a straight tube. The ceramic discharge tube is made of, for example, alumina sintered body.

[0004] The specification of Japanese Patent Application No. 178,415/1999 (EPO EP0982278, A1) discloses the following structure. The joining portion

BRIEF DESCRIPTION OF THE DRAWINGS

- [0012] Fig. 1 is a cross sectional view schematically showing the state wherein a porous bone structure 2 is provided between a sealing member 4 and a metal member 7.
- [0013] Fig. 2 is a cross sectional view schematically showing a joined body.
- [0014] Fig. 3 is a cross sectional view schematically showing the state wherein a porous bone structure 2 is provided between a sealing member 4 and a metal member 7.
- [0015] Fig. 4 is an SEM photomicrograph, showing the joint interface between a metal member and a sealing member.
- [0016] Fig. 5 is a photomicrograph showing an enlarged view of a part of Figure 4.
- [0017] Fig. 6 is a diagram illustrating the photomicrograph of Figure 4.
- [0018] Fig. 7 is a diagram illustrating the photomicrograph of Figure 5.
- [0019] Fig. 8 is a diagram showing the relationship among the heat resisting temperature, the thermal stress, and the corrosion resistance of the high pressure discharge lamp.
- [0020] Fig. 9 is a diagram showing the relationship between the crystallinity and the failure rate of a ceramic discharge tube during the thermal cycle test under the temperature of 950°C.
- [0021] Fig. 10 is a diagram showing the relationship between the crystallinity and the failure rate of a ceramic discharge tube during the thermal cycle test under the temperature of 1050°C.
- [0022] Fig. 11 is a diagram showing the relationship between the weight % of SiO<sub>2</sub> and the crystallinity of a ceramics.
- [0023] Fig. 12 is a diagram schematically showing a layered structure of the joining portion of the joined body of Figure 1 and the thermal coefficients of the layers.
- [0024] Fig. 13 is a cross sectional view showing the state wherein a clogging member 19 is inserted within the metal member 7 of the high pressure discharge lamp of Figure 1.

[0025] Fig. 14 is a cross sectional view showing a high pressure discharge lamp after the metal member 7 of Figure 12 and a sealing member 19 is joined to form a sealing portion 21.

[0026] Fig. 15 is a diagram schematically showing an example of a high pressure discharge lamp.

[0027] Fig. 16 is a cross sectional view schematically showing an embodiment of an end portion of a high pressure discharge lamp according to the invention, wherein a metal member 7 is joined to the inner wall surface of a sealing member 4 substantially along the full length of the wall.

[0028] Fig. 17 is a cross sectional view schematically showing an embodiment of an end portion of a high pressure discharge lamp according to the invention, wherein a metal member 7 is joined to an end portion 1a of a discharge tube 1 and a metal element 7 and a metal axis of an electrode system 27 is electrically connected by a metallized layer 32, covering the surface of the end portion 1a.

[0029] Fig. 18 is an enlarged view showing the region near a hollow 31 shown in Figure 17.

[0030] Fig. 19 is a cross sectional view schematically showing an end portion of a high pressure discharge lamp according to another embodiment of the invention, wherein a metal member 7 is joined to an inner wall surface of the end portion 1a of a discharge tube 1 substantially along the full length of the surface.

[0031] Fig. 20 is a cross sectional view schematically showing an end portion of a high pressure discharge lamp according to another embodiment of the invention, wherein a through hole 46 of a sealing member 39 is sealed by a joining portion 6D of the invention.

[0032] Fig. 21 is a cross sectional view schematically showing an end portion of a high pressure discharge lamp according to another embodiment of the invention, wherein an opening 40 of an end portion 1a of a discharge tube 1 is sealed by a joining portion 6E of the invention.